

“The Grazing Manager” (TGM): Decision Support Software for Graziers

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The link between cows and grass is so obvious that some of the details may be taken for granted. Everyone knows that a cow should gain two or more levels of Body Condition through May and June in most areas of Nebraska. However, there are some important assumptions that go along with this “knowledge”. The most significant assumptions are:

1. Stocking Rate: That the number of animals in a given area is at a level that allows them to select daily diets of sufficient quality and quantity to support the gain in condition.
2. Growing Conditions: That moisture and temperature are adequate to support predicted forage production.

A grazing manager’s task is complicated by this region’s highly variable growing conditions, both within and between years. This means that **the correct stocking rate that will achieve animal production, landscape, and wildlife management objectives is a moving target**. “The Grazing Manager” (TGM) is designed to help managers develop stocking and grazing plans that are correct for growing conditions as expected and/or actually experienced.

Fortunately, there is a fairly early indicator of “correctness” that is observable at the pasture level, and at any point in time. This indicator is the level of forage consumed compared to the total forage available, or **forage utilization**.

Forage utilization is a crucial element in almost all aspects of grazing management. It indicates the quality of diet cattle are consuming on any given day. By observing the amount of leaf versus stem, or green versus dormant plant material consumed, a manager has an idea of how cattle are doing. This can be done well before body condition changes are noticeable, so it can be an early indicator of livestock production.

Landscape objectives also depend on forage utilization, or more accurately, the amount of plant material “left over” after grazing. These objectives may include range condition improvement, wildlife habitat preservation and development, or just the way a place “looks”. Landscape objectives for any part of a ranch can be achieved if grazing is managed to achieve appropriate levels of forage utilization, at the proper time.

Obviously, forage utilization isn’t the only factor involved in range health and cattle performance. Time and frequency of grazing also affects plant health, and thereby landscape objectives. Cattle need good drinking water and appropriate protein and mineral supplementation to meet production goals. Still, important as all other management factors are, correct stocking rate is the basic key to a successful grazing program.

A manager draws on experience, research results, and other information to develop a grazing plan that will lead to goal achievement. TGM can help analyze the plan, track its application, and monitor its effectiveness. If growing conditions change, TGM can indicate the need to react, then help evaluate and monitor new plans. Over the years, TGM builds a record of management decisions and their effectiveness in the growing conditions experienced. TGM should be part of an overall planning and

monitoring program, that could include tools such as photos, SanDRIS, range transects, and financial records to evaluate management and track progress.

Program Inputs

Every set of resources and goals is unique. Because TGM is adaptable, it is an effective tool for any forage resource and climate. All inputs to the program are specific to the ranch being managed. The inputs are:

1. **Forage Growth Cycles.** TGM projects the planned consumption of forage grown in 12-month periods. Users define the forage year and annual forage growth patterns for their area. This can be customized to fit different forage resources such as native range or planted forages. This will be discussed in more detail later in this paper, but Figure 3 is an example of the growth curve used to distribute forage production over the year.
2. **Individual Pasture Production.** Each pasture is identified with a name, its size, and its production per acre. The user is also required to state the level of forage utilization at which the production is attained. A unique feature of TGM is that a pasture's production per acre is stated in terms of its ability to provide for animals' weight maintenance and gain. This differs somewhat from the customary "AUMs per acre", as it accounts for *nutritional demand due to weight changes over time*.
3. **Herd Information.** TGM quantifies livestock demand by tracking the animals in the various herds that exist during the forage year. This information

Kind / Class	Number	Date In	Weight In	Date Out	Weight Out	Demand Days
Cows	100	6/1/2007	1150	11/1/2007	1150	10793
Cows	100	3/26/2008	1150	5/31/2008	1150	4696
Calves	100	6/1/2007	250	10/15/2007	525	10489
Calves	100	4/17/2008	150	5/31/2008	250	3119
Bulls	4	5/23/2008	1850	5/31/2008	1800	0
Bulls	4	6/1/2007	1800	7/21/2007	1700	105

Figure 1: Herd inputs table. Animal information is entered in the Herd table.

4. **Pasture Utilization Goals.** Each year, the manager will plan forage utilization levels for each pasture. These are based on desired cattle performance and landscape goals since achievement of both depends so heavily on forage utilization levels. This identifies meaningful targets for the grazing plan.
5. **Grazing Plans.** The plan for each herd's location throughout the forage year is necessary to place grazing demand on pastures. TGM is kept up to date as grazing progresses through the year. *Planned* and *actual* grazing data allocates demand to individual pastures. Grazing plans for herds are entered in the table shown in Figure 2.

Pasture Name	Date In	Date Out	Days Grazed	Notes
SW Cow Past.	6/1/2006	7/16/2006	46	
West Cow Past.	7/17/2006	9/5/2006	51	
NE Cow Past.	9/6/2006	11/1/2006	57	
NW Hills	3/26/2007	4/15/2007	21	
SW Cow Past.	4/16/2007	5/31/2007	46	

Figure 2: Grazing inputs table. One for each herd.

6. **Haying and Burning Plans.** If hay is to be harvested, or if prescribed burning is planned, this “demand” is accounted for. If an unplanned burn occurs, TGM is able to account for this also. Again, actual experience (tons harvested; percent burned) is recorded, providing a complete “usage” history for the forage year.
7. **Adjustments to “Normal” Forage Growing Conditions.** The heart of TGM’s ability to anticipate imbalances between livestock grazing demand and forage production, is an adjustable Forage Growth Curve (Figure 3). Forage production calculations, both for daily distribution and total production, are based on this curve.

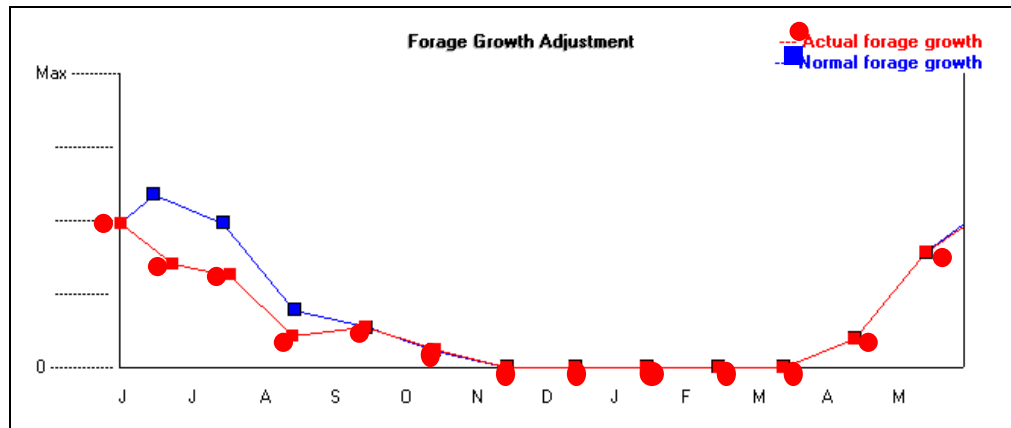


Figure 3: Forage Growth Curve. When growing conditions are not “normal”, the user will adjust the curve to reflect actual conditions. Naturally, weather and forage utilization observations that differ from the expected are hints that the curve may need adjustment. The adjustable growth curve presents unlimited “what if” opportunities so a manager can preview the effects of abnormal growing conditions. This can be invaluable when developing contingency plans and decision dates, etc.

Using TGM’s Outputs

TGM helps managers evaluate stocking rate by graphically displaying the balance between forage demand, forage supply, and the utilization target. This balance can be calculated and graphed for any single pasture, group of pastures, or for the whole ranch. Additionally, any day of the year can be queried for the actual numbers displayed in the graph. The “Cumulative Forage Balance” graph shown in Figure 4 is one of the graphs produced by TGM, and is probably the most frequently used output. Other outputs will not be discussed in detail here.

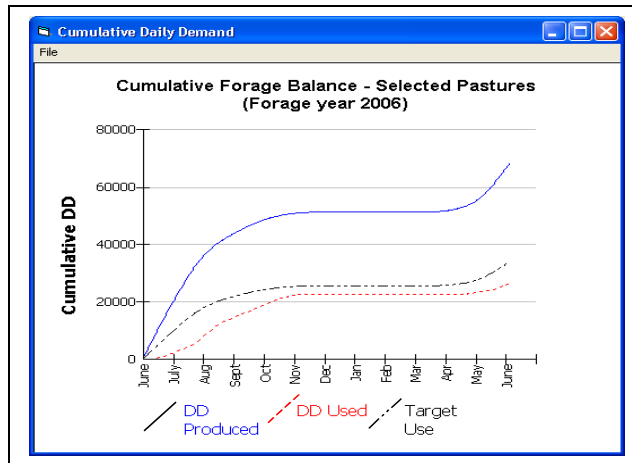


Figure 4: Cumulative Forage Balance graph. This graph is based on the “Normal” line in the Forage Growth Curve in Figure 3. It depicts the accumulation of forage grown, and the accompanying target utilization level, for the full 12-month forage year. The “DD Used” line indicates livestock use as it accumulates during the year.

Whether evaluating a grazing and stocking plan, monitoring its application, or evaluating results, the Cumulative Forage Balance graph in Figure 4 tells a manager several things:

1. If the level of *target utilization* is based on livestock and landscape objectives, those objectives are likely to be met, since the DD Used line is below the Target Use line (planning stage).
2. Since the demand is projected to be less than the target utilization, increasing livestock numbers, or adding a winter grazing period might be considered (planning stage, or evaluating at year end). The “planning” function can occur at any point during the year, not just when planning grazing and stocking at the beginning.
3. Highest livestock demand appears to be well matched to the period when forage is producing the best nutrition. That is, the “production” and “use” curves rise and level out together.
4. Perhaps the production of the pastures has increased over the years. This is a validation of grazing practices, and demonstrates TGM’s use as a long-term monitoring tool. Up to 5 years can be combined and graphed together to show progress toward management goals.

But what about the years that are not “normal”? These happen all too frequently, and managers must deal with them in ways that still allow them to meet their livestock and landscape objectives. TGM helps analyze these situations, and possible reactions to them. This helps a manager make a decision, confident that it was made with the best information available.

Adjustments to the Growth Curve (Figure 3) will change the production and target lines in the Cumulative Forage Balance graph (Figure 4). The demand line (DD Used) will be affected by changes in livestock numbers and weights in the Herd Table (Figure 1). Changes in grazing plans (Figure 2) will also be immediately reflected in the demand line.

The Forage Growth Curve in Figure 3 shows both the “normal” curve, and an “adjusted” curve based on observations of growing conditions and forage utilization. The Cumulative Forage Balance graph in Figure 5 shows how the balance between production and demand can be affected by an adjusted Forage Growth curve. Demand is based on the same livestock numbers and grazing plan as in Figure 4.

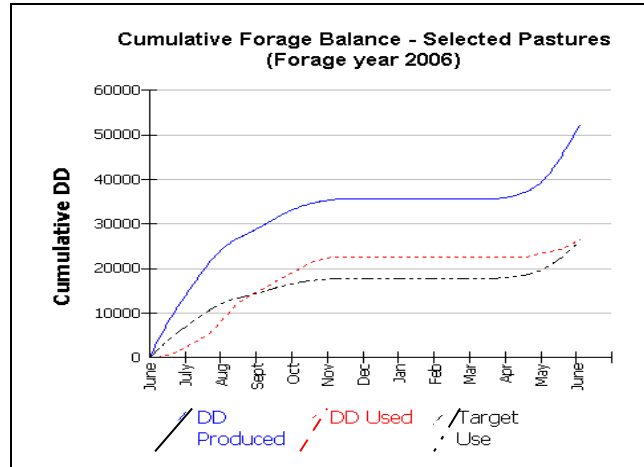


Figure 5: Cumulative Forage Balance graph resulting from the “Actual Forage Growth” line in Figure 2 (same Herd and Grazing Plan as Figure 4).

This graph (Figure 5) now tells a different story. Management’s objectives may be in jeopardy. Ideally, this graph would be generated very early in a grazing season, possibly as a “what if” scenario when the manager suspects a tough growing season may be in the offing. If the cattle in this group of pastures are expected to grow, and/or get pregnant, the rancher is alerted to the possibility that problems could develop, beginning in the latter half of August or early September.

Several options may be available to deal with this situation, but the choices usually get fewer as the crisis nears. TGM can test such actions as reducing cattle numbers (at various dates), early weaning, and bringing in feed. The resulting graphs can help find the best choice from the forage balance, livestock performance, and landscape points of view. Additional financial and logistical analysis is necessary to determine what to actually do, of course.

As plans are implemented, TGM is kept up-to-date with observations of growing conditions and forage utilization, actual cattle numbers, and actual grazing dates and locations. TGM can indicate when pre-defined conditions are reached that trigger implementation of contingency plans. These conditions will be specific to each ranching operation, and could be a measure such as “x% less than normal production by a certain date”. A more lagging indicator would be observations that planned grazing periods are resulting in higher than expected utilization. It might simply be a “gut feeling” verified by the graphs in TGM. The most important point is that a drought contingency plan should be in place, and the conditions that will trigger its implementation should be identified in advance.

Skills and Level of Detail

TGM is a computer program, and users need to have at least basic computer skills, including some basic file handling. Observing and evaluating growing conditions and forage utilization are necessary. Most managers possess these skills and it is just a matter of making their observations fit in the “box” of a computer program’s

requirements. Users must establish benchmarks for acceptable forage utilization and livestock performance that are meaningful to them. Often, this helps to clarify a manager's perceptions. As a result, TGM can be an effective tool to help transfer knowledge and skills to new generations of grazing managers.

The required level of input detail is relative to management's needs. Some operations are customarily stocked at conservative levels. This may give them plenty of time to react to adversity, so only very general livestock information, grazing records, and observations of growing conditions and utilization are needed. On the other hand, operations that must be able to react quickly to opportunity or adversity will benefit from highly detailed observations and inputs. This lets management anticipate and react very quickly to changing conditions.

Any degree of uncertainty or unfamiliarity justifies greater detail. Embarking on any new venture certainly requires a monitoring system that will indicate success or failure as quickly as possible. TGM is a valuable tool, and should be used at a level of detail that provides management with the most useful feedback.

Summary

Stocking rate is the basic factor that determines success or failure in achieving livestock and landscape objectives in grazing operations. TGM focuses management attention on forage utilization, the earliest indicator of "correct" stocking rate for existing growing conditions. TGM tracks and projects forage utilization as it relates to utilization targets and growing conditions. This can alert managers when changes in stocking and grazing plans are needed.

Users can adapt the program to any grazing philosophy, forage type, and ranch location. Input detail is adaptable to user's needs. Stocking and grazing plans can be tested in TGM, in initial planning and in re-planning modes. Actual grazing and stocking is recorded annually, along with the growing conditions experienced. Over time, a database of management decisions, growing conditions, and livestock and forage production is developed that tracks progress to goal achievement.

Contingency plans for dealing with drought or other adverse conditions can be designed, and then tested in TGM. The graphic and numeric outputs can be used to indicate when a drought plan should be triggered.

All information required to use TGM is available on the ranch. Experienced grazing managers already possess all the necessary observational skills. TGM can be an effective training tool for new grazing managers.

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